



2017 KANSAS

SEVERE WEATHER AWARENESS WEEK

MARCH 5 - 11th 2017

TORNADO SAFETY DRILL

Tuesday, March 7th, 2017

10am CST/9am MST



INFORMATION PACKET

National Weather Service

KANSAS SEVERE WEATHER AWARENESS WEEK
MARCH 5-11th, 2017

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2016 Kansas Tornado Facts

Tornadoes: 102 (40 above the 1950-2016 average of 62)
 (16 above the past 30 year average of 86)
 (1 above the past 10 year average of 101)

Fatalities: 0 **Injuries:** 12

Longest track: 25.1 miles (Ottawa-Dickinson, May 25, EF4)

Strongest: EF4 (Ottawa-Dickinson, May 25)

Most in a county: 13 (Ford)

Tornado days: 22 (Days with 1 or more tornadoes)

Most in one day: 34 (May 24)

Most in one month: 63 (May)



Tornado SW of Dodge City on May 24, 2016. Photo courtesy of Wes Hovorka.

First tornado of the year: March 30 (Cowley County, 4:48 pm CDT, EF0 0.5 mile length, 50 yard width)

Last tornado of the year: December 25 (Saline County, 1:53pm CST, EF0, 0.13 mile length, 40 yard width)

Length of tornado season: 270 days (Days between first and last tornado)

-----2016 Monthly Tornado Totals-----

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	
EF5	0	0	0	0	0	0	0	0	0	0	0	0	0	0%
EF4	0	0	0	0	1	0	0	0	0	0	0	0	1	1%
EF3	0	0	0	0	5	0	1	0	0	1	0	0	7	7%
EF2	0	0	0	0	4	0	1	0	0	1	0	0	6	6%
EF1	0	0	0	2	12	0	1	0	0	5	0	0	20	20%
EF0	0	0	1	7	41	0	4	2	0	4	1	8	68	67%
Total	0	0	1	9	63	0	7	2	0	11	1	8	102	100%
Percent	0	0	1	9	62	0	7	2	0	11	1	8		

Violent (EF4—EF5) in red, Strong (EF2-EF3) in yellow, Weak (EF0-EF1) in green. Monthly totals in gray.
 (Percent values may not add to 100% due to rounding)

Annual Highlights: A total of 102 tornadoes occurred in Kansas in 2016 which is well above the long term average (records beginning in 1950) but close to more recent 10 and 20 year averages. 2016 is in 9th place (9th highest tornado total) in the overall 67 year tornado record. Fortunately no tornado-related fatalities occurred in Kansas, but 12 injuries were reported with 5 of those occurring on May 25th as an EF4 tornado tracked for 25 miles across Ottawa and Dickinson counties. This EF4 tornado was the only violent tornado occurring in Kansas last year.



Tornado NW of Chapman on May 25, 2016. Photo courtesy of Ruffin McDaniel.

The absence of tornadoes in June is noteworthy with only one other year (1980) in the 67 year tornado record with no tornadoes reported in June. On average the state of Kansas sees about 14 tornadoes in June, while May is normally the most active month with 23 tornadoes. In 2016, a total of 63 tornadoes occurred in May, but this falls well short of the record 127 tornadoes which occurred in May of 2008.

The costliest Kansas tornado in 2016 occurred on July 7th in Greenwood County. An EF2 tornado traveled 3 ½ miles through Eureka impacting a total of 152 structures and completely destroying 31 homes. Damage is estimated at approximately 3.8 million dollars.

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Kansas Tornado Statistics

by county

1950 - 2016

TORNADOES, FATALITIES, AND INJURIES

County	Tor	Fat	Inj	County	Tor	Fat	Inj	County	Tor	Fat	Inj
Allen	27	0	4	Greenwood	43	0	10	Pawnee	50	0	1
Anderson	15	3	12	Hamilton	26	0	1	Phillips	41	0	1
Atchison	15	0	11	Harper	62	0	1	Pottawatomie	32	1	5
Barber	37	0	2	Harvey	49	1	63	Pratt	71	3	10
Barton	96	2	38	Haskell	32	0	10	Rawlins	47	0	4
Bourbon	19	0	7	Hodgeman	55	0	4	Reno	79	0	22
Brown	45	0	5	Jackson	31	4	17	Republic	60	0	3
Butler	78	28	225	Jefferson	40	0	101	Rice	46	0	6
Chase	39	0	2	Jewell	43	0	2	Riley	29	0	51
Chautauqua	19	0	0	Johnson	42	0	12	Rooks	51	0	6
Cherokee	37	4	66	Kearny	45	0	0	Rush	51	0	8
Cheyenne	42	0	0	Kingman	64	0	1	Russell	78	1	7
Clark	39	0	0	Kiowa	59	11	74	Saline	42	0	66
Clay	42	1	31	Labette	42	1	29	Scott	55	1	1
Cloud	50	1	8	Lane	47	0	2	Sedgwick	89	13	360
Coffey	23	0	5	Leavenworth	30	2	30	Seward	38	0	15
Comanche	42	0	2	Lincoln	33	0	2	Shawnee	54	18	528
Cowley	73	77	293	Linn	14	0	3	Sheridan	38	0	0
Crawford	33	4	43	Logan	29	0	0	Sherman	109	0	0
Decatur	47	0	5	Lyon	46	7	222	Smith	45	0	2
Dickinson	38	1	17	Marion	47	1	2	Stafford	70	3	5
Doniphan	19	0	2	Marshall	32	0	1	Stanton	22	0	0
Douglas	40	1	48	McPherson	54	1	16	Stevens	25	1	5
Edwards	50	0	7	Meade	51	0	0	Sumner	84	5	14
Elk	24	2	8	Miami	20	4	10	Thomas	46	0	1
Ellis	62	0	6	Mitchell	48	0	5	Trego	63	5	101
Ellsworth	50	0	0	Montgomery	34	1	1	Wabaunsee	34	1	26
Finney	97	1	41	Morris	33	0	7	Wallace	35	0	4
Ford	98	0	2	Morton	20	1	2	Washington	40	2	12
Franklin	29	3	34	Nemaha	37	0	3	Wichita	35	0	4
Geary	18	0	3	Neosho	31	0	4	Wilson	16	0	0
Gove	54	0	3	Ness	53	0	4	Woodson	12	0	8
Graham	39	0	0	Norton	30	0	0	Wyandotte	10	2	36
Grant	25	0	9	Osage	44	17	6				
Gray	50	0	3	Osborne	45	0	13				
Greeley	37	0	0	Ottawa	32	2	12	Total	4588	237	2924

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Kansas Tornadoes 2016

Cheyenne	Rawlins	Decatur	Norton	Phillips	Smith	Jewell	Republic	Washington	Marshall	Nemaha	Brown	Doniphan	
					1		1	1				Atchison	Leavenworth
Sherman	Thomas	Sheriden	Graham	Rooks	Osborne	Mitchell	Cloud	Clay	Riley	Pottawatomie	Jackson	Jefferson	Wyandotte
				2	1		1	4	2	1	Shawnee	Douglas	Johnson
Wallace	Logan	Gove	Trego	Ellis	Russell	Lincoln	Ottawa	Dickinson	Geary	Wabaunsee	3	Franklin	Miami
		1	1	2			3	1	1	1	Osage	Anderson	Linn
Greeley	Wichita	Scott	Lane	Ness	Rush	Barton	Ellsworth	Saline	Morris	Lyon	Coffey	Allen	Bourbon
2	7	6	8	6	2	1	1	4	1				
Hamilton	Kearny	Finney	Hodgeman	Pawnee	Stafford	Reno	Rice	McPherson	Marion	Chase	Butler	Greenwood	Woodson
1	3		7	Edwards		Harvey				1	2	Wilson	Neosho
			Gray	Ford	Pratt	Sedgwick	Kingman	Butler	Greenwood	Elk	Montgomery	Labette	Cherokee
Stanton	Grant	Haskell	1	13	2	1	1	1	2				
					Kiowa	1	1	1	1				
Morton	Stevens	Seward	Meade	Clark	Comanche	Barber	Harper	Sumner	Cowley	Chautauqua	Montgomery	Labette	Cherokee
2		1			1			1	4			2	

102 tornadoes (multiple county crossers)

Severe Weather Terminology

- **Severe Thunderstorm** – The National Weather Service issues severe thunderstorm warnings for thunderstorms that are currently producing or are capable of producing winds of 58 mph or stronger and/or hail one inch in diameter or larger. Severe thunderstorms often may be much stronger than this minimum criteria, so it is a good idea to take severe thunderstorm warnings seriously.
- **Tornado** – A tornado is a violently rotating column of air, in contact with the ground, either as a pendant from a cumuliform cloud or underneath a cumuliform cloud, and often (but not always) visible as a funnel cloud. A funnel cloud is a condensation cloud typically funnel-shaped and extending outward from a cumuliform cloud and is associated with a rotating column of air.
- **Flash Flood** – A flash flood is flooding that occurs very rapidly usually within 6 hours of heavy rainfall. Flash flooding may occur along creeks, rivers or streams. It can also occur in low lying or urban areas where drainage is poor. Water levels can rise very quickly during flash flooding including locations that did not receive the heavy rainfall but are located downstream from areas that received an extreme amount of rainfall. Flash flooding can occur in the winter months when rain falls on existing snowpack and causes it to melt rapidly. Flooding is the number one severe weather killer in the U.S.

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Check out a Storm Spotter and Weather Safety Training presentation near you this spring...

Each spring, the National Weather Service offices that serve the state of Kansas conduct storm spotter and weather safety training sessions in most counties in the state. The sessions are free and open to the public. You are not required to become a storm spotter nor will you have to take a test; however, the presentations provide a great deal of information on severe weather in Kansas. They cover severe weather safety and ways to get weather information from the National Weather Service. You can meet a meteorologist from your local National Weather Service office.

The schedule for storm spotter training sessions varies in each community, please check out www.weather.gov and click on your location for more information on a training session in your area.

Did you know that there are seven National Weather Service offices that serve portions of Kansas?

The NWS offices are located in Goodland; Dodge City; Wichita; Topeka; Hastings, Nebraska; Pleasant Hill, Missouri; and Springfield, Missouri. Each office is staffed by a team of highly trained meteorologists, technicians, electronics technicians, information technology specialists, hydrologists, and administrative assistants. The NWS offices are staffed 24 hours a day, seven days a week, 365 days a year.

Contact the NWS office in your area to learn more about weather, weather safety, NOAA Weather Radio, office tours, or to learn more about careers in meteorology in the NWS or in NOAA. We are here to serve you!

Kansas Tornado Facts

Days with more than 20 tornadoes

<u>Date</u>	<u>#Tornadoes</u>
05/23/08	70
04/14/12	43
06/15/92	39
05/05/07	36
05/24/16	34
06/04/55	33
05/29/04	28
10/26/06	28
05/25/97	25
06/09/05	25
05/15/91	24
07/07/04	23
05/06/15	22
04/26/91	21

Kansas Tornado Count by Decade

1950s: 560
1960s: 457
1970s: 303
1980s: 339
1990s: 789
2000s: 1192
2010s: 572 (through 2016)

Most Tornadoes in One Episode

May 23, 2008	70 Tornadoes
April 14, 2012	43 Tornadoes
June 15-16, 1992	41 Tornadoes

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Weather-Ready Nation

National Oceanic and Atmospheric Administration

The Weather-Ready Nation Ambassador™ initiative is the National Oceanic and Atmospheric Administration's (NOAA) effort to formally recognize NOAA partners who are improving the nation's readiness, responsiveness, and overall resilience against extreme weather, water, and climate events.

As a WRN Ambassador, partners commit to working with NOAA and other Ambassadors to strengthen national resilience against extreme weather. In effect, the WRN Ambassador initiative helps unify the efforts across government, non-profits, academia, and private industry toward making the nation more ready, responsive, and resilient against extreme environmental hazards.

WRN Ambassadors serve a pivotal role in affecting societal change — helping to build a nation that is ready, responsive, and resilient to the impacts of extreme weather and water events.

To be officially recognized as a WRN Ambassador, an organization must commit to:

- Promoting Weather-Ready Nation messages and themes to their stakeholders;
- Engaging with NOAA personnel on potential collaboration opportunities;
- Sharing their success stories of preparedness and resiliency;
- Serving as an example by educating employees on workplace preparedness



As a WRN Ambassador, you will serve as a change agent and leader in your community. You will inspire others to be better informed and prepared, helping to minimize or even avoid the impacts of these natural disasters. To support your efforts, NOAA can:

- Provide outreach content about creating a Weather-Ready Nation;
- Explore innovative approaches for collaboration with your organization;
- Assist with StormReady® opportunities for communities;
- Recognize your organization as a WRN Ambassador; and
- Share the WRN Ambassador logo for your use.

Together we will inform and empower communities, businesses, and people to make pre-event decisions that can be life-saving and prevent or limit devastating economic losses. We are a nation of many communities, and it is only through connected communities that we will achieve this goal.

Any organization across all levels of government, businesses large and small, non-profit and non-governmental organizations, and academia can become a WRN Ambassador. The WRN Ambassador initiative is intended for organizations and designed to help serve the public by strengthening our national resilience against extreme weather events.

http://www.nws.noaa.gov/com/weatherreadynation/amb_tou.html

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Greensburg - 10 years later

On May 4th, 2007 an enormous tornado nearly wiped out the entire town of Greensburg, Kansas causing EF5 damage. It was the strongest recorded tornado since the May 3rd, 1999 Moore/Oklahoma City tornado. Despite a tornado warning with a lead time of 26 minutes, the town of approximately 1500 persons still lost 11 lives. Some of those fatalities were even in basements that unfortunately were filled with a tremendous amount of debris. Remarkably, the tornado took down the town's only water tower which also stood above the infamous "hand dug" well and meteorite. The tornado also destroyed a dozen homes and a church that were south of town in rural Kiowa County.

Water tower before the tornado



The aftermath



The first warning for the tornado that eventually went through Greensburg was issued at 8:55 PM on that May evening back in 2007. The first warning specifically mentioning the town was issued at 9:19 PM. The tornado entered the south side of Greensburg at 9:45 PM and changed the lives and landscape forever.

For those that have never been to Greensburg, where most streets were completely tree lined, a few of the images on subsequent pages show the remarkable damage.

Greensburg

Downtown before



Downtown after



Downtown now



*The downtown area has rebuilt, not to the extent of 2007
but certainly more so than after the tornado.*

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Two days after the tornado, most of the streets were clear of debris, but the devastation was obvious.



Remarkable changes have taken place during this past decade. Considering that around 800,000 cubic yards of debris had to be removed after the devastation and utilities had to be reconstructed, it's amazing what has transformed. Although the year 2016 population of around 800 has not recovered to pre-2007 levels, a large number of residents and new folks to the area took to rebuilding the town. Today there are many state-of-the-art buildings, and the city prides itself with the most LEED certified buildings per capita in the world!

A landmark, the water tower stands proud and tall overlooking the slowly growing town.



But a stark reminder of what hasn't been rebuilt exists on the northwest side of Greensburg.



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The following image was taken the day after the tornado looking across the north side of Greensburg.



Many empty lots remain with even a few stark reminders of the damage as some of the original tree stumps remain.



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Facts about the May 4th, 2007 Greensburg Tornado

65 minutes	The tornado began in Comanche Co. at 9:00 PM and ended at 10:05 PM near
1.7 miles	Maximum width of the tornado
28.8 miles	Distance the tornado travelled
205 MPH	Approximately the strongest surface wind in parts of town
5	Maximum damage rating on the Enhanced Fujita Scale
11	Deaths that were a direct result from the May 4, 2007 tornado
961	Homes & businesses destroyed
216	Homes & businesses with major damage
307	Homes & businesses with minor damage
800,000	Cubic yards of debris removed from Greensburg
15	Agencies tasked by FEMA for the response and recovery
21	Greensburg residents hired by FEMA to work in recovery positions
7,604	Number of volunteers registered by AmericCorps for the recovery and cleanup
39,172	Meals served by the American Red Cross mobile feeding stations through all of
57,786	Hours of documented work logged by volunteers
\$2.8 million	Amount of disaster assistance approved under Individuals & Households Program
\$12.7 million	Costs paid by FEMA for work assigned to other federal agencies to provide specialized work, technical assistance, personnel, etc. to support the response to the
\$23.1 million	Approved funding under FEMA's Public Assistance Program. Projects included
\$30.7 million	Amount of low interest loans provided by the U.S. Small Business Administration
SOURCE:	The National Weather Service and the

In an instant, Greensburg was changed forever. We should never have the notion that “this will never happen to me” because it can and in some cases it will. Tragically eleven lives were lost to this tornado. Based on the amount of destruction that number could have been much higher. No doubt lives were saved from adequate warning, preparation and response. The National Weather Service urges **YOU** to react quickly to warnings and threatening weather situations and take shelter.

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2016 Severe Weather Summary

Extreme East Central and Northeast Kansas

National Weather Service Pleasant Hill, MO

May 26th, 2016 - Johnson, Leavenworth, Atchison, Leavenworth, and Wyandotte counties

The far north and east counties in Kansas found themselves on the eastern edge of a widespread severe weather event on May 26th. While tornadoes formed in north central and northeast Kansas, the Kansas City metro Kansas counties experienced a few non-tornadic supercells that brought large hail and strong winds approaching 70 mph. The largest reported hail in far eastern Kansas that day was tennis ball sized in Doniphan County.

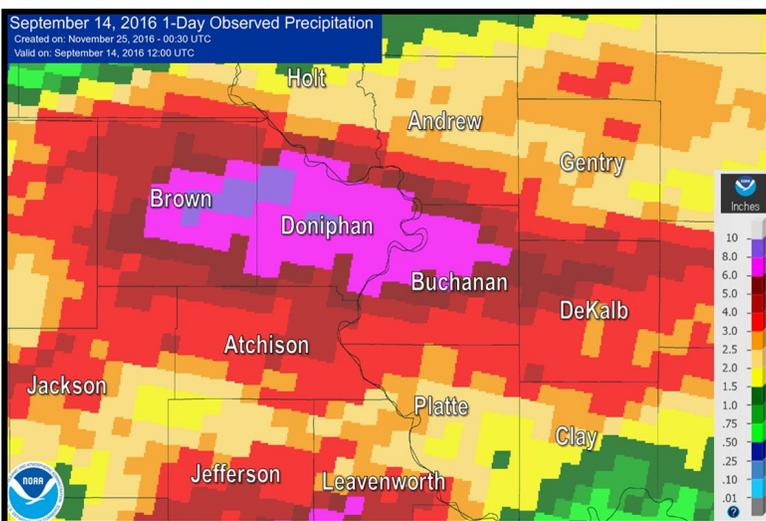


A supercell moves from Kansas into Missouri near the Johnson Co (KS) and Jackson Co (MO) line west of the NWS office in Pleasant Hill, MO on August 24, 2016.

Picture courtesy of @Rarexform

August 24th, 2016 - Johnson and Leavenworth counties

On the evening of August 24th, several supercells moved through eastern Kansas and into western Missouri, producing areas of strong winds and large hail across Johnson and Leavenworth counties. One of these supercells caused a long stretch of Highway 169 to be closed due to fifteen power poles being snapped by 70 to 80 mph winds. Hail as large as tennis balls was reported in Leavenworth County just east of Lawrence and just west of where the power pole damage occurred. While no tornado occurred from these storms, one of the supercells came very near the NWS office in Pleasant Hill, Missouri and produced a brief funnel cloud that was visible to the staff members at the office.



Observed precipitation from September 13-14th across far northeastern Kansas. Over 7 inches of rain fell across a large area with some areas reporting over 10 inches.

September 13-14th, 2016 - Doniphan, Atchison, and Leavenworth counties

Training thunderstorms brought several hours of moderate to heavy rain to extreme northeast Kansas. Several areas reported more than 7 inches of rain during the evening and overnight hours of September 13th into September 14th, and a few areas reported over 10 inches of rain from these storms. Fortunately there was not any widespread flooding; however, several areas roads had some water over them including waist-deep water over Ashpointe Road in Doniphan County.

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2016 Severe Weather Summary Northeast and North Central Kansas National Weather Service-Topeka, KS

The 2016 severe weather season was the most active since 2008 for tornadoes across north central and north-east Kansas. The most notable event occurred on May 25th when a strong EF-4 tornado moved across portions of Ottawa and Dickinson counties. Aside from the violent Dickinson County tornado, all other tornadoes that occurred across the area were either rated an EF-0 or EF-1 including an EF-1 that struck the town of Wamego on May 26th. Thankfully no fatalities occurred from any tornadoes in 2016.

May 25th – On the evening of Wednesday, May 25th, 2016, a weak outflow boundary and dry-line interacted across portions of north-central Kansas. Due to the “capped” nature of the environment that day, very few storms developed. However, one particularly strong tornadic supercell developed near this intersection during the late afternoon hours producing its first tornado at 6:08 PM. Approximately one hour later (7:07 PM) a second tornado touched down just north of Niles, KS. This violent tornado moved very slowly ESE, destroying nearly everything in its path. At its



EF4 tornado damage SW of Chapman

peak width it spanned nearly ½ of a mile. As the tornado approached I-70, great concern arose for Chapman Kansas taking a direct hit, and a Tornado Emergency was issued for the city. Fortunately, the tornado moved just south of the city by only one mile. The tornado finally dissipated near the Dickinson/Geary County line. A National Weather Service survey team determined the tornado produced EF-4 damage with winds upwards

of 180 MPH. Although numerous homes and buildings were destroyed, no serious injuries or deaths occurred! Two additional tornadoes occurred later that evening across Morris and Wabaunsee counties; however, only minor damage was reported.

May 26th – While cleanup efforts were ongoing across portions of the area from the tornadoes on May 25th, attention was refocused on the severe weather potential on May 26th. A powerful upper-level system lifted across the area during the early afternoon hours. A surface dry-line and warm



May 25h

*Tornado north of Solomon on May 25th.
Photo courtesy of Kris Sanders*

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*Tornado near Wamego on May 26th.
Photo courtesy of Chris Schmidt*

front were oriented along I-135 and I-70 respectively. Scattered supercell thunderstorms developed along the warm front during the early afternoon. Three tornadoes occurred with the first moving through the city of Wamego. An NWS survey team concluded the tornado was an EF-1 with winds approaching 110 MPH. Tree and roof damage was noted within the city. This tornado then moved northward through Louisville before dissipating. Two other brief, weak tornadoes occurred near Rossville and Silver Lake. Both of these were rated EF-0 with winds approaching 80 MPH.

April 26th – During the early morning hours of April 26th, 2016, thunderstorms developed over far northeast Kansas. The outflow from these storms would set the stage for severe storms during the afternoon. Very large hail, damaging winds and a few tornadoes occurred with no damage reported from the tornadoes. The most significant reports were of baseball sized hail. The widespread nature of the storms also lead to localized flash flooding.



*April 26th, Marshall County.
Photo courtesy of Pat Bussmann*



*Tornado south of Clay Center on Oct. 6th.
Photo courtesy of Scott Blair*

October 6th – On the evening of October 6th, a strong upper level storm system and cold front swept through northeast Kansas. Severe storms that developed in the late afternoon quickly became severe with large hail up to golf ball size, damaging winds, and two verified tornadoes. The two tornadoes occurred in Clay and Washington counties in northeast Kansas. Both were rated EF-1 with winds near 100 MPH. The strongest tornado of the day occurred just out of the forecast area in Saline County producing EF-3 damage east of Salina before dissipating near the Saline/Dickinson County line.

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2016 Severe Weather Summary

Portions of Central, South Central and Southeast Kansas

National Weather Service - Wichita, KS

I have heard many people say that 2016 was not a very busy year in regards to hazardous weather. In all actuality, central and southeast Kansas experienced normal to slightly above normal hazardous weather this past year at least when you look at convective weather which is known as storm season.

The winter season did not pack much of a punch with only a few minor winter weather scenarios. Once the spring storm season rolled in, several outbreaks occurred; two were highlighted by 2 EF-3 (136-165 mph) tornadoes and two others had rounds of significant flash flooding. Unfortunately, two people died in 2016 due to the flooding. This continues to amplify the importance of understanding flood safety and keeping a safe distance from flooded creeks, streams, or rivers.

For the 26 counties served by NWS Wichita 19 tornadoes were reported. This is normal when looking at the average number of tornadoes from 1950-2016 which is 18.9. However, we were well below the last ten year average of 26.8 and the 5 year average of 20.8. The first tornado of the year touched down on March 30th and the last was on December 25th.

July 7th

Two tornadoes occurred on July 7th in Greenwood County where a total of 152 structures were damaged or destroyed. Structural damage included: 31 homes destroyed, 23 homes with major damage, 32 homes with minor damage and 4 mobile homes destroyed. Preliminary estimates of damage totaled 3.8 million dollars. The most important and impressive aspect to this severe event was that there were zero injuries and zero fatalities. Much of this can be attributed to the preparedness efforts of Greenwood County officials and Wireless Emergency Alerts, <http://www.nws.noaa.gov/com/weatherreadynation/wea.html>. Interestingly, the EF3 that occurred well northwest of Eureka was only the 5th EF3 or stronger tornado during the month of July across Kansas since records began in 1950. (Courtesy of the Storm Prediction Center and National Center of Environmental Information)



Picture from storm damage survey in Greenwood County showing what is left of a residence that sustained a direct hit. Note the significant tree damage as well. Photo courtesy of NWS Wichita.

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Tornado damage from Saline County (I W. Kipp) on October 6th, 2016

October 6th

A second tornado outbreak similarly occurred during the “non-tornado” time frame in early October. A total of seven tornadoes touched down on this fall day with one being rated as an EF-3 in Saline County. This tornado moved NNE for approximately 6.5 miles. Fortunately this tornado remained over rural areas; however, about 12 homes were in the cross hairs with two taking direct hits. A manufactured double wide home which was held down by straps was completely lifted and destroyed. Additionally a jeep was rolled approximately 200 yards, and there was damage to farm equipment which had been tossed from their original locations. Another homestead

received significant tree and outbuilding damage and farm machinery was thrown across the property, including a combine that was rolled about 75 yards.

The Wichita NWS office issued a total of 337 severe thunderstorm warnings in 2016 with 486 reports of hail one inch or larger and/or winds greater than 58 mph. The 337 warnings and the 486 reports of severe weather were the second highest total between the years 2010-2016.

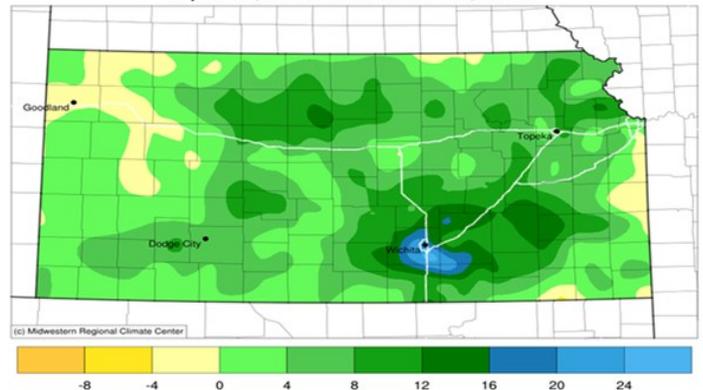
Flooding

Many locations across south central and southeast Kansas reported above normal precipitation from spring through the end of the year. In fact, numerous areas were at least four to eight inches wetter than normal since April with a large handful of sites greater than eight to twelve inches above normal. The wettest areas were over the southeast quarter of Kansas with a handful of sites twenty to twenty-five inches wetter than normal since April especially within about a 50 mile radius of Wichita. Two months were ranked in or near the top-ten wettest across the Sunflower State since records began in the 1890s: April (2nd wettest) and August (11th wettest). Wichita experienced its 2nd wettest January through October period on record (since 1889), tallying a staggering 49.68 inches at

Top rainfall totals across central, south-central southeast Kansas: April-October 2016

Location	April-October Precipitation (Inches)	Departure from Normal (Inches)
Rock 3 SW	55.33	+25.42
Haysville 3 SE	52.69	+25.16
Smileyberg 1 N	50.70	+20.06
Yates Center	49.01	+16.18
Potwin	48.53	+20.36
Wichita Eisenhower	47.41	+22.10
Thrall 4 S	46.06	+17.23
Madison	45.73	+15.48
Peck 2 S	45.17	+17.98
Fredonia	44.06	+11.69

Accumulated Precipitation (in): Departure from 1981-2010 Normals
April 01, 2016 to October 31, 2016



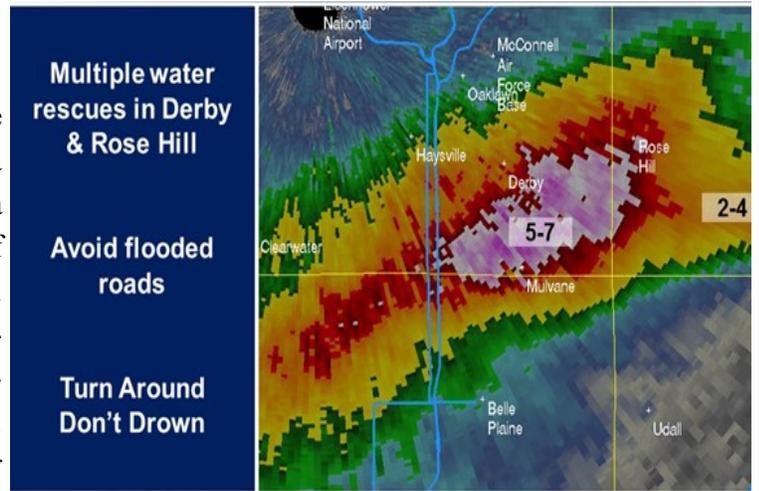
**KANSAS SEVERE WEATHER AWARENESS WEEK
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Eisenhower National Airport.

For residents of central and south central Kansas, the July 4th holiday weekend literally started with a ‘bang’ as numerous severe thunderstorms put on a fireworks show of their own. On the 2nd and 3rd of July, the nasty convection unleashed torrential rains. Hardest hit were Reno, Sedgwick and Butler counties where 4 to 8 inches inundated many areas. Areas in and around Wichita were swamped by 9 inches. The 5.72 inches measured on the 2nd at Eisenhower Airport not only washed out the calendar day record of 2.04 inches measured in 1989 by a staggering 3.68 inches, it was the 6th greatest 1 day rainfall of all time.

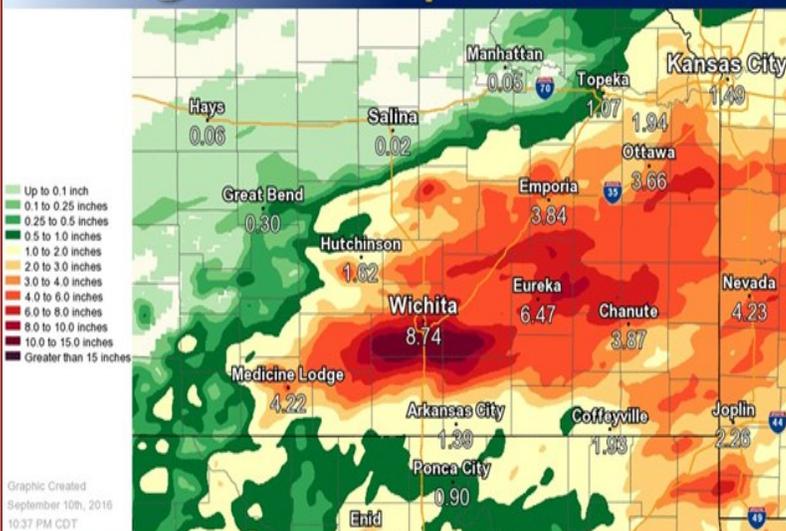
Wichita wasn’t the only location to be inundated with water during this time frame; Cow Creek in Reno and Rice counties also experienced flooding. In fact, Rice County remained under a flood warning for a week.

On August 19th and September 8-9th, flooding inundated much of southern Kansas. Thunderstorms produced rainfall rates around 2-3 inches per hour due to a very moist atmosphere. Several rounds of storms affected southern Sedgwick and southern Butler counties which resulted in 5 to 7 inches of rain; most of it falling during a two hour time period. This rapid amount of rain accumulation led to significant flash flooding, especially near the communities of Mulvane and south of Rose Hill. Numerous water rescues took place, and homes were evacuated.



Radar estimated rainfall south of Wichita, KS that caused significant flash flooding on August 19th, 2016.

3-Day Rainfall Through September 10th



3-day rainfall amounts that fell between September 8-10th, 2016

In early September, additional rainfall amounts proved extreme with widespread 3 to 6 inch amounts reported across much of the southeast quarter of Kansas. Localized amounts even exceeded 8 to 10 inches. Much of the rainfall came in relatively short periods with rainfall rates at times exceeding 3 inches per hour. This led to the second round of flooding for many locations that had just recovered from the previous event in August. Several water rescues were performed.

In conclusion, as we reflect on this past year it wasn’t quite as calm as people may believe. With so much hazardous weather and so few injuries and only two fatalities, it is important to highlight severe weather safety any time of the year.

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2016 Severe Weather Summary

North Central Kansas

National Weather Service - Hastings, NE

2016 was an active and wet year when compared to the previous few years. Severe weather started in April and continued at a steady pace through Labor Day. There was plenty of hail, wind and rain to go around. By the end of season, a region which began the season on the dry side, finished with a flurry of rain, which re-filled ponds, reservoirs and helped yield an excellent wheat crop. Here are a few of the more significant severe weather events in north central Kansas in 2016:

April and May Tornadoes

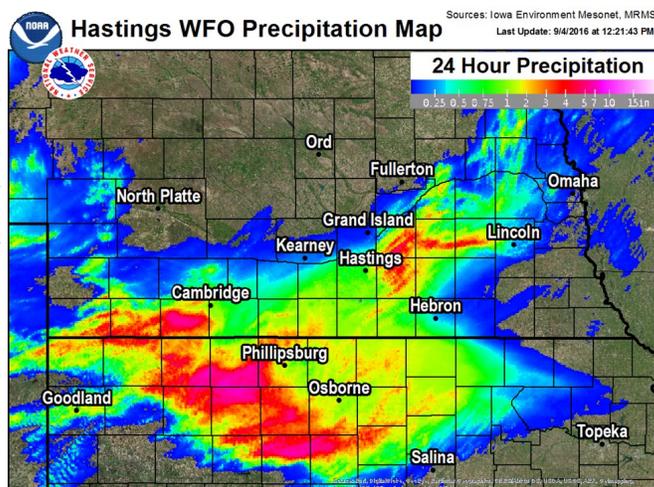
On April 26, a brief, quite rural tornado was filmed ten miles north of Kensington in Smith County. This EF-0 tornado lasted about two minutes and did not cause any damage. Stronger tornadoes impacted the area when they moved into southern Rooks County on May 8th. An EF-2 rated tornado started in Ellis County and crossed the county line south of Codell. The tornado was only on the ground in Rooks County for 0.4 of a mile so damage was limited. A second tornado southeast of Codell managed to damage fence, several power poles and trees on its nearly three mile path. This tornado was rated an EF-1 with a peak wind of 110 mph. Fortunately, the tornadoes crossed very rural areas and no homes were damaged, and no injuries were reported.



*Tornado damage south of Codell on May 8th, 2016.
Picture courtesy of NWS Hastings.*

Labor Day Floods

Heavy rainfall in the Solomon River Basin over the Labor Day weekend resulted in widespread flooding across Rooks, Phillips and parts of Osborne counties. Not only were 4 to 7 inches of rain common in Rooks and southern Phillips county, similar if not higher amounts fell to the west. The result was a new record flood crest on the North Fork of the Solomon River near Glade of 18.55 feet. This represented a 15 foot rise in the water level from where it began the day (around 3 feet). In Rooks County, Plainville topped the reported rain amounts with 6.50". Simply put, water was everywhere in this region with nearly every creek, river or drainage basin suffering some sort of flooding, which resulted in major damage to county roads causing several road closures.



*24 - hour Precipitation ending around noon
September 4th, 2016. Image courtesy of NWS Hastings*

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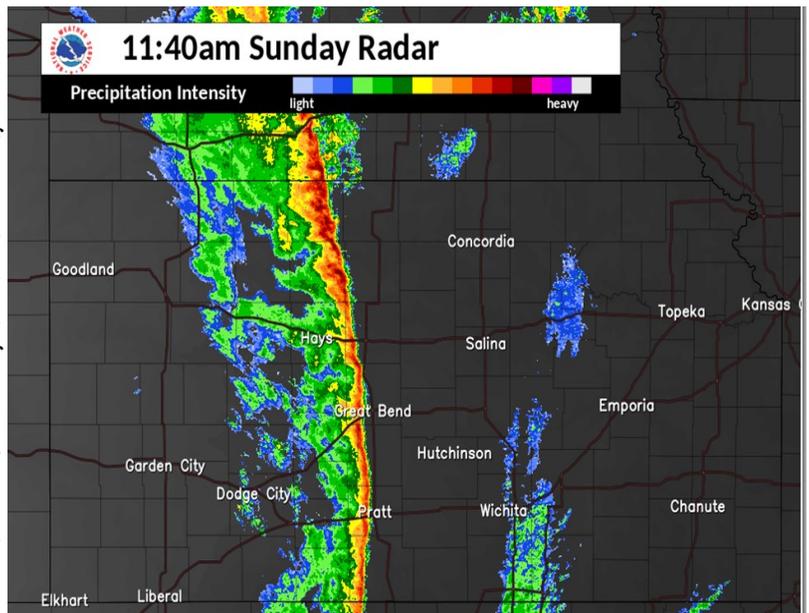
*Solomon River near Glade, Normally 15 feet wide.
Picture courtesy of Phillips county EM.*



*Flooding in Phillips County.
Picture courtesy of Phillips County EM.*

Christmas Day Tornado

Though the fall was generally dry and warm, an active year of weather culminated with severe weather on Christmas Day. A line of thunderstorms rolled into north central Kansas during the late morning hours produced 40 to 50 mph winds and torrential rain, but only lasted for about 15 minutes. Embedded in the line was a brief tornado northwest of Alton in Osborne County. This quick moving EF-0 rated tornado damaged some trees, a fence and caused minor damage to a farmstead on its path. Peak winds were estimated at 85 mph. A local resident saw “the swirl” approach over a ridge south of his home.



Radar image showing a line of Thunderstorms on Christmas Morning at 11:40am. Image courtesy of NWS Hastings

2016 North Central Kansas Tornado Statistics

Date	County	Rating	Peak Wind Speed	Begin Time	End Time	Path Length	Max. Path Width
April 26	Smith	EF-0	75 mph	7:47 PM	7:49 PM	0.3 mi.	100 yards
May 8	Rooks	EF-2	125 mph	7:21 PM*	7:23 PM*	0.4 mi.*	440 yards
May 8	Rooks	EF-1	110 mph	7:27 PM	7:33 PM	2.8 mi.	500 yards
Dec. 25	Osborne	EF-0	85 mph	11:45 AM	11:48 AM	1.9 mi.	50 yards

**Times and path in Rooks County only.*

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2016 Severe Weather Summary

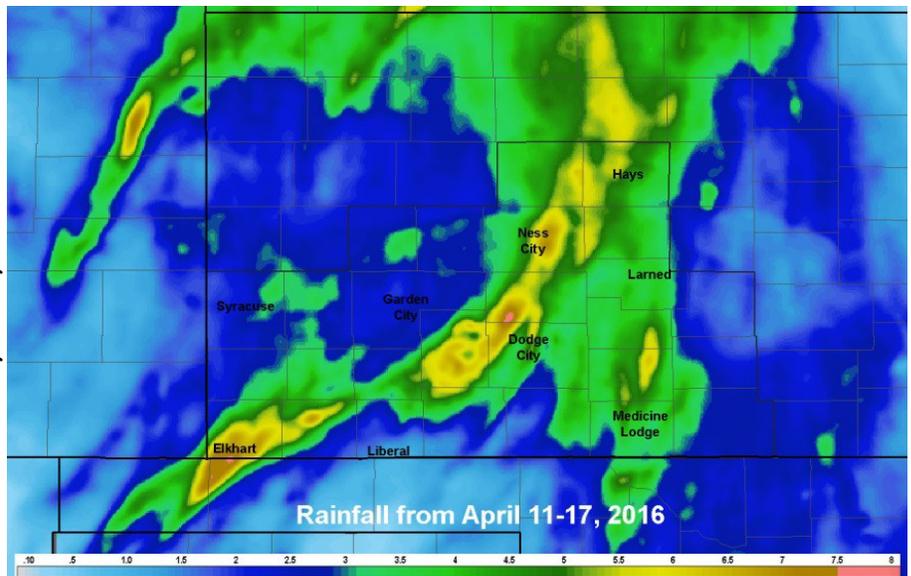
Southwest Kansas

National Weather Service - Dodge City

The year started out “warm” and dry with temperatures much above normal for January through March. In fact, it was the 10th warmest start to the year at Dodge City based on 141 years of record keeping. On February 18th, some locations across the area warmed into the lower 90s. This warm and dry weather set the stage for potentially rapid fire growth and an active fire weather season across the parched south central and southwest parts of Kansas. Unfortunately, the worst case scenario was realized on March 22nd and 23rd. A fire started in northern Oklahoma late on the 22nd and the fire spread rapidly into Comanche and Barber counties during the night. During the following day a dry line with very strong west winds moved through causing the fire to shift and rapidly advance towards Medicine Lodge. Luckily a cold front followed and pushed the fire southeast as the fire reached the edge of town. Nearly 400,000 acres of land burned before the fire finally was out. In addition, as much as four inches of snow fell on the fire area early on Easter Sunday which helped efforts to completely contain the fire.

A change in the weather pattern brought active weather to Kansas in April. Widespread heavy rainfall occurred especially on April 16-17th with many locations receiving more than four inches of rain. Parts of Ellis County received as much as nine inches of rain from this event. The impact of the excessive rainfall across a large area of Kansas was extremely great in that the rains resulted in heavy vegetation growth and subsequent evapotranspiration that favored continuation of precipitation through the summer season. This moisture also saved the winter wheat crop in western Kansas. Yields were greater than ever reported in many areas.

A total of 8.08 inches of rain fell in Dodge City in April. This was the wettest April on record and broke the previous record by 1.82 inches! Unfortunately, this rain also caused flooding to occur at many locations, but this might have been a small price to pay.



Rainfall estimates between April 11-17, 2016



Photo by Wesley Hovorka

Tornado from May 24th, 2016

The first tornadoes of the year occurred on April 15th when a supercell moved from the Oklahoma Panhandle into Morton County and produced an EF1 tornado northeast of Elkhart and an EF0 tornado northwest of Rolla.

Other tornadoes occurred in early May, but the big severe weather event for the year was May 24th.

A total of 34 tornadoes occurred on May 24th including five EF3 tornadoes. One tornado that moved just west of Dodge City was observed by a research team using “Doppler On Wheels;” this team measured wind speeds of just over 200 mph with brief spin-ups in the tornado vortex!

Dodge City was extremely fortunate in that many of these potentially violent tornadoes skirted the city to the west and north. Despite this fact, there was still significant damage in the area with two injuries reported. In addition, an unusual

anticyclonic tornado occurred during this outbreak and was rated an EF2 in Edwards County. The anticyclonic tornado tracked over five miles.

In July, of all months, another tornadic event unfolded in far western Kansas. On July 15th, an unusually strong tornado occurred east of Syracuse. Although it did only EF1 damage, it visually appeared to be much stronger. This tornado was well documented by a storm chaser and was a significant tornado from a significant supercell thunderstorm for a summer month.

The upper level flow during the summer favored southwest winds aloft with frequent invasions of high level tropical plumes originating in the south Pacific. Widespread heavy rainfall returned in July when Dodge City received 5.3 inches of rain. Although this was not a record, it was 2.22 inches above average for the month. Above average rainfall continued through August, but September, October, and November were dry. The exception was along I-70 where rains continued into September. Very heavy rainfall early on September 4th resulted in considerable flooding in northern Ellis County.

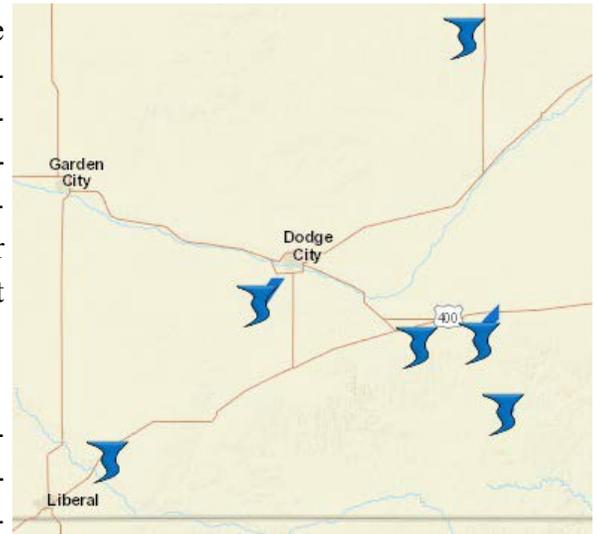
Anomalous warmth returned in October and November. The average temperature for October was seven degrees above normal, and October was the fourth warmest on record at Dodge City. The average temperature for November was 6.7 degrees above normal, making November the third warmest on record. The temperature rose to 101 in Dodge City and 100 in Garden City on October 17th. This was the only day on record in October during which the temperature reached or exceeded 100 degrees at both sites. The max temperature broke the previous record high for the month of October, and the records in Dodge City extend back to 1874.

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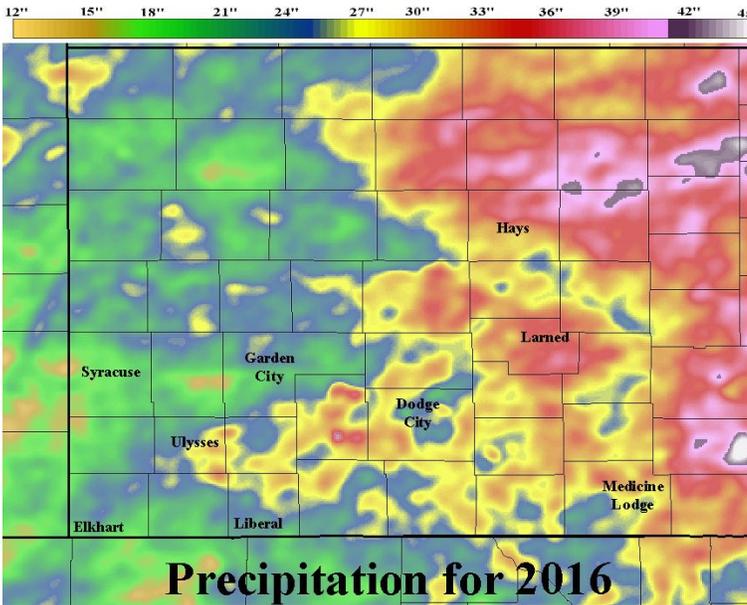
Ashland reached a record high of 102 which was the warmest temperature observed so late in the season for any location in the state of Kansas.

The warm weather continued into November. The temperature reached 87 in Dodge City on November 16th and broke the previous record by eight degrees. This was the warmest temperature observed so late in the season. As such, 2016 has the distinction of having the warmest high temperature so early on record and the warmest high temperature so late in the season. For the first eleven months of the year, 2016 was the sixth warmest on record.

The grand finale occurred Christmas Day when an unprecedented six tornadoes occurred across the local area. The early morning started with a very high amount of surface moisture as dew-point temperatures rose to around 60 degrees. This is unheard of for late December in southwest Kansas! A line of thunderstorms



Brief tornadoes on Christmas Day 2016.



marched across the area during the mid-morning hours and along the leading edge there were brief spin-ups. Five of these tornadoes caused minor damage.

Even though the end of 2016 was generally very dry, some areas (thanks to heavy spring and summer rains) ended up with a yearly precipitation total that was nearly double what is normal. A small area in southern Gray County had nearly 45 inches. It was so wet and humid in some areas that corn was rotting in the husk before it could be harvested!



Also be sure to check if your county emergency manager has a facebook page for your county.

Be sure to find your local NWS office on facebook

NWSDodgeCity

NWSSpringfield

NWSGoodland

NWSTopeka

NWSHastings

NWSWichita

NWSKansasCity

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2016 Severe Weather Summary

Northwest Kansas

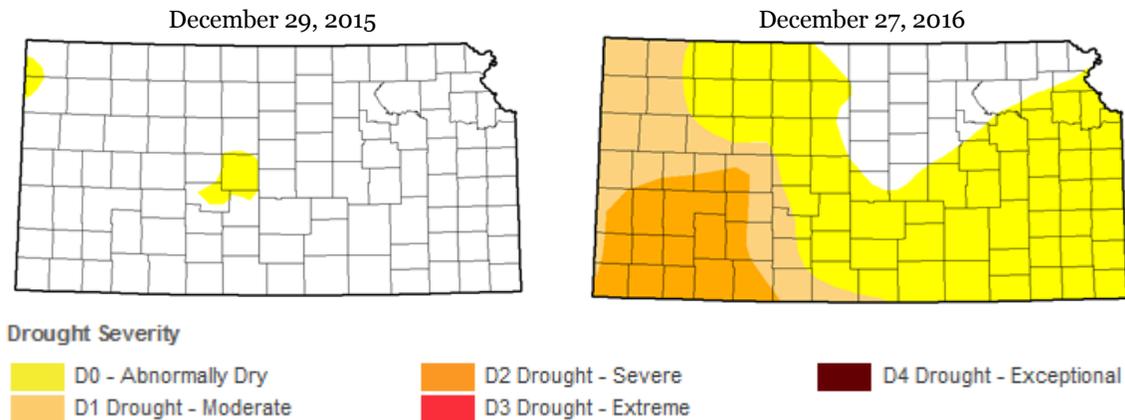
National Weather Service - Goodland, KS

Drought

The drought situation across the state took a turn for the worse in 2016 particularly during the fall months. Dry conditions began across northwest Kansas toward the end of summer. However, a slow moving weather system produced several rounds of thunderstorms in early September leading to heavy rainfall throughout the region. This provided a brief reprieve from late summer dry conditions.

Drought-free conditions quickly came to an end with a prolonged period of dry weather from mid-September through November. This was due to a large ridge of high pressure that remained stationary over the Plains, leading to well above normal temperatures with little precipitation. At Goodland Regional Airport, October 2016 ranked as the 5th warmest ever on record and the warmest since 1963. In addition, fall 2016 at Goodland was the 2nd warmest ever which finished with an average temperature of 57.1 degrees. This was 0.2 degrees below the warmest fall ever (1939). Goodland Regional Airport received 0.04 inches of precipitation during October which tied for the 10th driest. This was the driest October since 1999 when only 0.02 inches of precipitation were received.

Drought Monitor



Winter Weather

The first four months in 2016 avoided winter weather for the most part; however, there were a couple notable winter weather events. The first event was a substantial blizzard that swept through northwest Kansas on February 1st and 2nd. During the height of the storm, visibility was less than one quarter mile for several hours and winds gusted as high as 55 mph. In the end, many locations received over 12 inches of snow, and drifts were as high as three to five feet.

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A second winter weather event occurred on April 29th which caught many by surprise. A cold rain changed to snow for locations along the Colorado border. This winter storm also produced up to ten inches of snow in eastern Colorado. Snow accumulations were lighter in northwest Kansas with a range from a trace to 6 inches. The wet, slushy snow led to many accidents and slide offs along Interstate 70 in Sherman and Thomas counties. Several injuries were reported. Westbound Interstate 70 was closed for several hours as emergency responders cleaned up the accidents.

Severe Weather

The 2016 severe weather season started out slowly across the Tri-State Region with the first severe weather event of the year taking place in eastern Colorado on April 15th. Northwest Kansas did not experience severe weather until May 7th and 8th. On this weekend, storms produced large hail up to the size of baseballs and one short-lived tornado in Gove County.

The last ten days in May were very active in terms of severe weather across northwest Kansas. Storms occurred almost every day producing several tornadoes, many reports of large hail and wind damage, and several instances of flash flooding. One notable storm was a large supercell that moved across Wichita County on May 22nd. This storm produced a large wedge tornado. The tornado remained over open country east of Lydia, KS in southeastern Wichita County. No damage was reported.

On May 26th, a significant severe weather event took place across the High Plains. A line of severe thunderstorms developed in eastern Colorado and spread northeast across northwest Kansas. In addition, several supercell thunderstorms developed ahead of the thunderstorm complex. The line of storms produced measured wind gusts up to 91 mph and widespread wind damage. Severe wind damage was reported in Kanorado. These storms also produced: hail to the size of baseballs, a few funnel clouds, heavy rain, and widespread blowing dust. Interstate 70 was closed for a brief period due to near zero visibility from blowing dust.



*Blowing dirt associated with line of severe thunderstorms.
Photo courtesy of Dave Floyd*



*Supercell north of Leoti, KS.
Photo courtesy of Jon Zeitler*

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After a very active end of May, northwest Kansas was given a reprieve from severe weather for June. Only a few days of severe weather were reported primarily towards the end of the month. Reports included large hail to the size of golf balls, damaging winds to 65 mph, heavy rainfall, and minor flash flooding.

Thunderstorm activity picked up once again in July. Several rounds of late evening and overnight thunderstorms were observed throughout the month. These storms produced hail up to the size of a grapefruit, damaging wind gusts to 70 mph, and flash flooding. One particular storm on July 7th was responsible for the grapefruit size hail in northern Cheyenne County. This storm continued southeast and several additional reports of baseball size hail were received from Rawlins and Thomas counties. The storm strengthened as it moved further southeast into Logan and Gove counties producing hail to 3.75 inches in diameter.



Supercell thunderstorm approaching Goodland on September 15, 2016. Picture taken just prior to baseball size hail and 70-80 mph winds. Photo courtesy of Tim Lynch

The 2016 severe weather season had one last surprise for northwest Kansas. On September 15th, a supercell thunderstorm crossed the Colorado border and moved roughly parallel to Interstate 70. Reports of golf ball to baseball size hail accompanied by winds gusting to 80 mph were common across Sherman, Thomas, Sheridan and Graham counties. Widespread damage was reported due to wind-driven hail especially in Sherman and Thomas counties. A large majority of homes and structures received damage to siding, windows and roofs, especially on the west-facing side where the full force of wind driven hail was felt. In addition, large swaths of crops were lost due to these storms.

Flooding

Several days of flooding were observed throughout the warm season. However, one flash flood event in particular stood out: September 2nd through September 4th. Four distinct rounds of slow moving thunderstorms spread across northwest Kansas, producing very heavy rain in addition to severe weather. Flash flooding became the main focus as heavy rains in excess of six to ten inches fell over several locations. Cheyenne, Graham and Norton counties were hit especially hard on the evening of September 3rd. During this evening, several rounds of heavy rains were received which sent creeks well out of their banks and washed away numerous country roads. Water rescues were conducted in Norton County as a few motorists were swept away by swollen creeks. Unfortunately, one individual did not survive the raging flood waters. This was the only fatality in northwest Kansas related to severe weather and flash flooding during 2016.

2016 Severe Weather Summary

Southeast Kansas

National Weather Service - Springfield, MO

Compared to past years, 2016 was very quiet in regards to hazardous weather across far southeast Kansas. Factors contributing to a less active weather season were a persistent pattern with the jet stream displaced from the area and the lack of deep Gulf of Mexico moisture. The overall weather pattern was not conducive for much in the way of active weather.

The year started off with a quiet winter season across southeast Kansas. The overall weather pattern and jet stream led to above average temperatures and below average snowfall. A dusting of snow occurred on January 21st across the area. This inactive weather pattern continued into the spring season. There were only a hand full of thunderstorms which produced isolated reports of marginally large hail and damaging wind gusts in April and May.

The middle of summer in 2016 turned out to be a little more active with a couple rounds of severe weather. One round of storms hit at the end of June and the other round hit after the July 4th holiday. There were a few reports of minor wind damage and isolated flash flooding across portions of Crawford, Cherokee, and Bourbon counties. Quiet weather continued into the fall season with above average temperatures and below average rainfall. The first frost and freeze of the season was delayed about a month past the average for much of the area.



Also be sure to check if your county emergency manager has a Twitter account for your county.

Be sure to find your local NWS office on Twitter

NWS Dodge City, Kansas at [@NWS Dodge City](#)

NWS Goodland, Kansas at [@NWS Goodland](#)

NWS Hastings, Nebraska at [@NWS Hastings](#)

NWS Kansas City, Missouri at [@NWS Kansas City](#)

NWS Springfield, Missouri at [@NWS Springfield](#)

NWS Topeka, Kansas at [@NWS Topeka](#)

NWS Wichita, Kansas at [@NWS Wichita](#)

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Sirens Are An Outdoor Warning System

Every year the National Weather Service and the emergency management communities get together and provide severe weather information for the public. Each year we emphasize the fact that the outdoor sirens are just that...an Outdoor Warning System. Every year we get a multitude of calls telling us that the sirens can't be heard while in the house.

Severe weather season usually begins in the early spring in Kansas. We all need to be prepared for severe weather at any time of the day or night and at any time of year. The National Weather Service, emergency management, law enforcement, the 9-1-1 center, and the fire department cannot notify every individual of the possibility of severe weather in their town. The local media outlets and All Hazards NOAA Weather Radio are your best sources for information concerning severe weather watches and warnings. Do not wait for the sirens to be your warning system at home. Sirens may not be working if the power is out and oftentimes cannot be heard indoors. Sirens may not be activated for other severe threats such as damaging straight line winds in excess of 60 mph, large hail, and flooding. Monitor NOAA Weather Radio and local media then take the appropriate action for the severe weather threat. If it appears that a severe thunderstorm is approaching your location, do not wait for the outdoor sirens but take immediate action to protect your life and the lives of others in your home.



Hundreds of volunteer storm spotters, amateur radio operators, and first responders provide the first line of defense every time there is severe weather in the local area. They do this because they care about the people in their communities and want to make sure those people are given the best chance at survival. The storm spotters, emergency managers, law enforcement and other volunteers immediately relay severe weather reports to the National Weather Service. The National Weather Service in turn disseminates that information to the media and public through warnings, statements, and local storm reports. Getting the word out to the public in a timely manner may save lives. When severe weather threatens at night while most people sleep, it can be especially dangerous. Oftentimes in the heat of the spring and summer, we cannot hear outdoor sirens over running air conditioners. A NOAA Weather Radio with a back-up battery can make the difference for you and your family.

Take responsibility...listen to the media...take protective action....survive to enjoy the wonderful warm sunny days that also come this time of year.

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Americans live in the most severe weather-prone country on Earth, and the state of Kansas is no exception. Each year a startling 10,000 thunderstorms, 2,500 floods, 1,000 tornadoes, and 10 hurricanes impact the United States. Potentially deadly severe weather impacts every American. Communities can rely on the National Weather Service's StormReady program to help them guard against the ravages of Mother Nature.

What is StormReady?

Ninety percent of all presidentially declared disasters are weather related. Through the StormReady program, NOAA's National Weather Service gives communities the skills and education needed to survive severe weather – before and during the event. StormReady helps community leaders and emergency managers strengthen their local hazardous weather operations.

StormReady Does Not Mean Storm Proof

StormReady communities are better prepared to save lives from the onslaught of severe weather through better planning, education and awareness. Communities have fewer fatalities and property damage if they plan before dangerous weather arrives. No community is storm proof, but StormReady can help communities save lives.

How Can My Community Become StormReady?

The entire community – from the mayor and emergency managers, to business leaders and civic groups – can take the lead on becoming StormReady. Local National Weather Service forecast offices work with communities to complete an application and review process. To be recognized as StormReady, a community must:

- ✓ Establish a 24-hour warning point and emergency operations center.
- ✓ Have more than one way to receive severe weather warnings and forecasts and to alert the public.
- ✓ Create a system that monitors local weather conditions.
- ✓ Promote the importance of public readiness through community seminars.
- ✓ Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.

Go to <http://www.stormready.noaa.gov> for more information.

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National Weather Service Kansas



Deaf & Hard of Hearing Awareness

www.weather.gov

Lightning Safety



If you see lightning, you are within striking distance. Seek safe shelter **IMMEDIATELY!**

- Outdoor Activities: Minimize the risk of being struck by moving indoors or to vehicles
- Inside Activities: Things to avoid
 - Corded phones
 - Computers
 - Other electrical equipment
 - Indoor/Outdoor pools
 - Tubs and showers and other things connected to metal plumbing
- Watch for developing thunderstorms and be ready to act when lightning is seen.
- Lightning can strike as far as 10 miles from an area where it is raining.

NOAA Weather Radio

What is it?

A way to notify you of dangerous weather during the day or even while you're sleeping.

How does it notify you?



*Battery powered too so will still work if power goes out!

Includes ASL Instructions

Where do you get them?

- [Vendors of NWR receivers](#) packaged to accommodate needs including grocery stores
- Harris Communications (800) 825-6758 or harriscomm.com (search [weather](#))
- Homesafe, Inc. (800) 607-6737 or homesafeinc.com (click [SPECIAL NEEDS PRODUCTS](#))
- Silent Call (800) 572-5227 or silent-call.com

How much does it cost?

- Roughly \$100 for a system packaged with external alarm devices

Other options?

- RCA sells a flat screen AlertGuard television with built-in NWR receiver
- Sign-up for weather alerts from a local media station or [other application](#) on a smartphone
- [Wireless Weather Alerts](#) (WEA) for extreme weather warnings

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